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**Economic Impacts of Improved Connectivity for ASEAN:
An Application of the Geographical Simulation Model**

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Master Plan on ASEAN Connectivity and Comprehensive Asia Development Plan 2.0: Geographical Simulation Analysis

Ikumo Isono

1. Introduction

Enhancing physical and institutional connectivity is no doubt one of the essential measures for ASEAN to deepen the economic integration, to strengthen ASEAN's competitiveness and to enhance people-to-people connectivity. The ASEAN Economic Community (AEC) Blueprint, the Master Plan on ASEAN Connectivity and the Brunei Action Plan clearly emphasized the importance of hard infrastructure development and transport facilitation, and specified the prioritized transport facilitation measures (ASEAN 2009, 2010a and 2010b).

Transport cooperation in ASEAN has been carried out according to consecutive five year plans since the 1980s, and the key transport initiatives in the ASEAN Transport Action Plan (ATAP), such as the ASEAN Highway Network (AHN), the Singapore-Kunming Rail Link (SKRL), the Roadmap for Integration of the Air Travel Sector (RIATS), the Roadmap towards an Integrated and Competitive Maritime Transport in ASEAN (RICMTA), and three framework agreements on transport facilitation, were incorporated into the AEC Blueprint. The Brunei Action Plan (BAP), adopted in November 2010 as the latest five-year plan, updated the current status and timelines of these transport initiatives, based on a comprehensive assessment of the ATAP and other related issues (ASEAN, 2010b; ERIA Study Team, 2010). These transport initiatives were then incorporated into the Master Plan on ASEAN Connectivity (MPAC) as key strategies to enhance physical and institutional connectivity within ASEAN and with other parts of the world (ASEAN, 2010a).

ERIA submitted the Comprehensive Asia Development Plan (ERIA 2010) to the 5th East Asia Summit in October 2010, as a grand spatial design for infrastructure development in East Asia. The conceptual framework of the CADP, which was elaborated based on new waves of international trade theory namely the fragmentation theory and new economic geography, demonstrated how the region can pursue deepening economic integration as well as narrowing development gaps. This claim was supported by simulation analyses on the impacts of logistic enhancement to the region using the Geographical Simulation Model (IDE/ERIA-GSM). The Institute of Developing Economies (IDE-JETRO) together with ERIA has been developing a Geographical Simulation Model (GSM) since 2007 (Kumagai *et al.* 2013)¹. It is possible to predict the type of physical or institutional integration that favorably or adversely affects the concerned regions at the sub-national level. It is also possible to predict how such a policy measure to facilitate international transaction that affects the traffic of which routes, identifying potential bottlenecks to enable extracting the full merits of economic integration.

¹ GSM has been enhanced and improved with financial and manual contribution by Economic Research Institute for ASEAN and East Asia (ERIA) through our joint research.

CADP also provided a long list of prospective infrastructure projects that would be important to realize the policy recommendation of the CADP. The simulation analysis revealed that development of the Mekong-India Economic Corridor (MIEC) had a larger impact on the Mekong region than the other GMS economic corridors, i.e., the East-West Economic Corridor (EWEC) and the North-South Economic Corridor (NSEC). While the MIEC is promising, there remain two missing links with the MIEC: (1) Transit transport between Bangkok and Ho Chi Minh City, and (2) the Dawei deep seaport and a link between Dawei and Kanchanaburi. IDE/ERIA-GSM suggested that firms want to utilize those links and the development of the links will boost the economic activities in the Mekong region. The Comprehensive Asia Development Plan Phase II project (Kimura and Umezaki, 2011) highlighted several potential links in ASEAN-India Connectivity such as the MIEC and the Trilateral Highways.

The objectives of this paper are to overview the status of MPAC prioritized projects, to conduct an impact analysis on the comparison between the MPAC prioritized projects and the CADP projects by IDE-GSM, and to make policy recommendations to facilitate their steady implementation as integral steps toward the establishment of the AEC.

2. The ASEAN Highway Network²

The AHN has been one of the flagship projects in ASEAN transport cooperation since the adoption of the Ministerial Understanding on the Development of the ASEAN Highway Network Project in September 1999. Building upon the routes and technical standards of the Asian Highway project under the UNESCAP, this Ministerial Understanding added several new routes in ASEAN, defined ASEAN's own technical standards, and set timelines for implementation. To date, 23 routes have been designated as forming part of the AHN, and its total stretch is 38,400 km. The end goal of the AHN is to upgrade all sections to be Class I or above by 2020³. In February 2007, the ASEAN countries came to an agreement to designate 21,206 km of the AHN as Transit Transport Routes (TTRs) in Protocol 1 of the ASEAN Framework Agreement on the Facilitation of Goods in Transit (AFAFGIT). Since then, the designated TTRs have been regarded as priority routes to be developed or improved in the AHN. As illustrated as blue bold lines in Figure 1, designated TTRs cover key international routes to ensure physical connectivity among ASEAN countries and with neighboring countries.

² The sections 2 to 6 are revised from Umezaki and Isono (2012), which was presented at ASEAN Senior Transport Officials Meeting on 22 May 2012.

³ According to the ASEAN Highway Standards, access controlled motorways paved with asphalt or cement concrete are classified as "Primary," four or more lanes highways paved with asphalt or cement concrete are classified as "Class I", two-lane roads paved with asphalt or cement concrete are classified as "Class II", and narrow two-lane roads with double bituminous treatment are classified as "Class III." Road sections failed to meet the standards of "Class III" are regarded as "Below Class III".

Figure 1: The ASEAN Highway Network (AHN) and the designated Transit Transport Routes (TTRs)



Source: ERIA Study Team (2010).

In the AEC Blueprint, ASEAN committed to implementing the AHN projects, with an explicit emphasis on the upgrading of those sections of TTRs currently below Class III. This was to be completed by 2009. Reflecting delays in implementation, the BAP revised the timeline with priority on the sections below Class III on TTRs and ‘missing link’ sections, and this was adopted as one of the prioritized projects in the MPAC. Table 1 shows the prioritized sections identified in the MPAC.

Table 1: Below Class III Sections on TTRs and Missing Link Section of the AHN in 2010

AH No.	Country	Section	Length	Status
AH12	Lao PDR	Vientiane – Luang Prabang	393 km	Below Class III
AH15	Lao PDR	Ban Lao – Namphao	98 km	Below Class III
AH1	Myanmar	Tamu – Mandalay – Bago – Myawaddy	781 km	Below Class III
AH2	Myanmar	Meikthila – Loilem – Kyaington – Tachileik	593 km	Below Class III
AH3	Myanmar	Kyainton – Mongla	93 km	Below Class III
AH112	Myanmar	Lehnya – Khongloy	60km	Missing Link
AH123	Myanmar	Dawei – Maesamee Pass	141 km	Missing Link

Source: ASEAN (2010a).

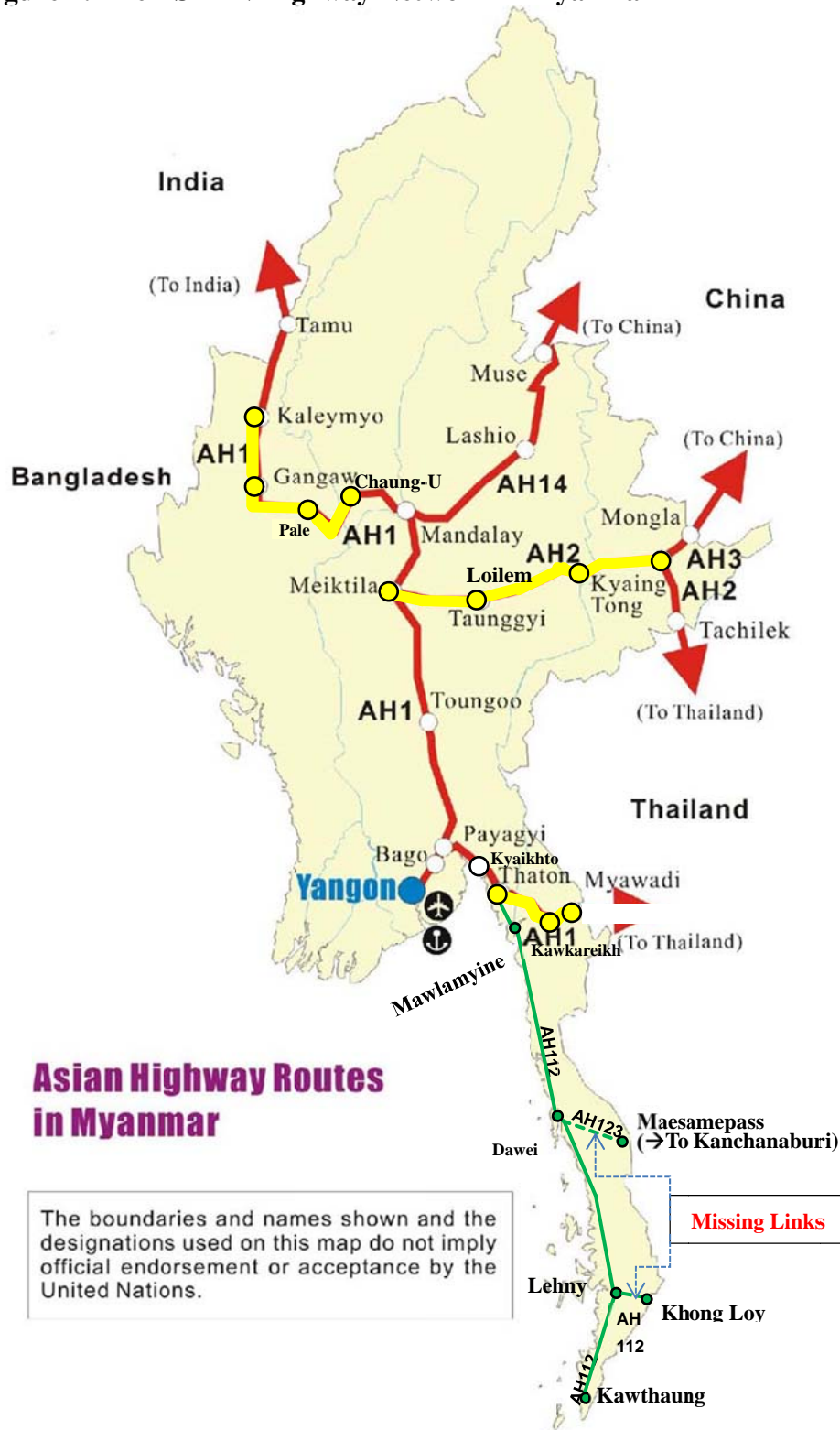
According to the latest publicly available official information (ASEAN, 2012), AH12 section between Vientiane and Luang Prabang and AH15 section between Ban Lao and Namphao (98km) are both classified as Class III. That is, as updated from the MPAC information, there are no longer any sections below Class III on TTRs in Lao PDR. In addition, Lao PDR has been upgrading Class III sections on AH15 and AH3 although the construction work is delayed.

Combining the information from ASEAN (2012), the Asian Highway Database developed and maintained by the UNESCAP (2003), and others, we identified remaining sections below Class III on AH1 in Myanmar as the 195km section between Thaton and Myawaddy and the 379km section from Chaung-U to Kalemyo. The section below Class III between Kawkaleik and Myawaddy has been undergoing upgrading work since January 2012 with official assistance from Thailand. The length is identified as 46km in this official note. Although the expected date of completion (April 2014) is behind the timeline agreed in the BAP (by 2012), such visible progress in the implementation is obviously an important step.

The remaining missing link sections on the AHN are both in Myanmar. One of them, unpaved road between Dawei and the Maesamee Pass in AH123 (141km) has been constructed by the Italian–Thai Development (ITD) Public Company Limited and the Max Myanmar Company Limited, as a part of a comprehensive development project in Dawei and surrounding area. The other missing link is a 60km section from Lehnya to Khongloy.

All this information is summarized in Figure 2.

Figure 2: The ASEAN Highway Network in Myanmar



Source: Umezaki and Isono (2012). The original map is downloaded from the website of UNESCAP. Note: Yellow lines indicate sections below Class III on TTRs, green lines are the AHN route other than the Asian Highway routes, and green dashed lines indicate missing links on the AHN.

3. The Singapore Kunming Rail Link

The Singapore–Kunming Rail Link (SKRL) has two lines connecting Bangkok to Kunming, an eastern line through Cambodia and Vietnam, with a spur line between Lao PDR and Vietnam, and a western line through Myanmar (Figure 3).

Figure 3: The Singapore Kunming Rail Link (SKRL)



Source: SKRL Factsheet, ASEAN Secretariat (2007).

Although ASEAN agreed in the AEC Blueprint to “complete the development of all missing links in the Singapore–Kunming Rail Link,” only the section between Poipet and Siosiphon in Cambodia, which is a part of the missing link between Thailand and Cambodia, is listed in the strategic schedule attached to the AEC Blueprint so that it should be completed by 2009. As it turned out, even this target year was not met due to a delay in implementation. Reflecting the delay, ASEAN revised the implementation timeline in the BAP, in which an explicit priority is given to the eastern line of the SKRL in view of limited financial resources and the greater challenges in constructing the western line. Based on the BAP, the MPAC listed the construction of the missing link sections between Thailand and Cambodia, and between Cambodia and Vietnam as one of the prioritized projects. Out of the missing link between Thailand and Cambodia, a 6km section between Aranyaprathet and Klongluk in Thailand was targeted to be completed by 2014, whereas the 48km section between Poipet and Siosiphon in Cambodia was to be completed by 2013. Out of the missing link between Cambodia and

Vietnam, a 257.35km section in Cambodia between Bat Doeung near Phnom Penh and the Vietnam border, and the 129km section in Vietnam between Loc Ninh and Ho Chi Minh City are agreed in the BAP to be completed by 2015 and 2020 respectively.

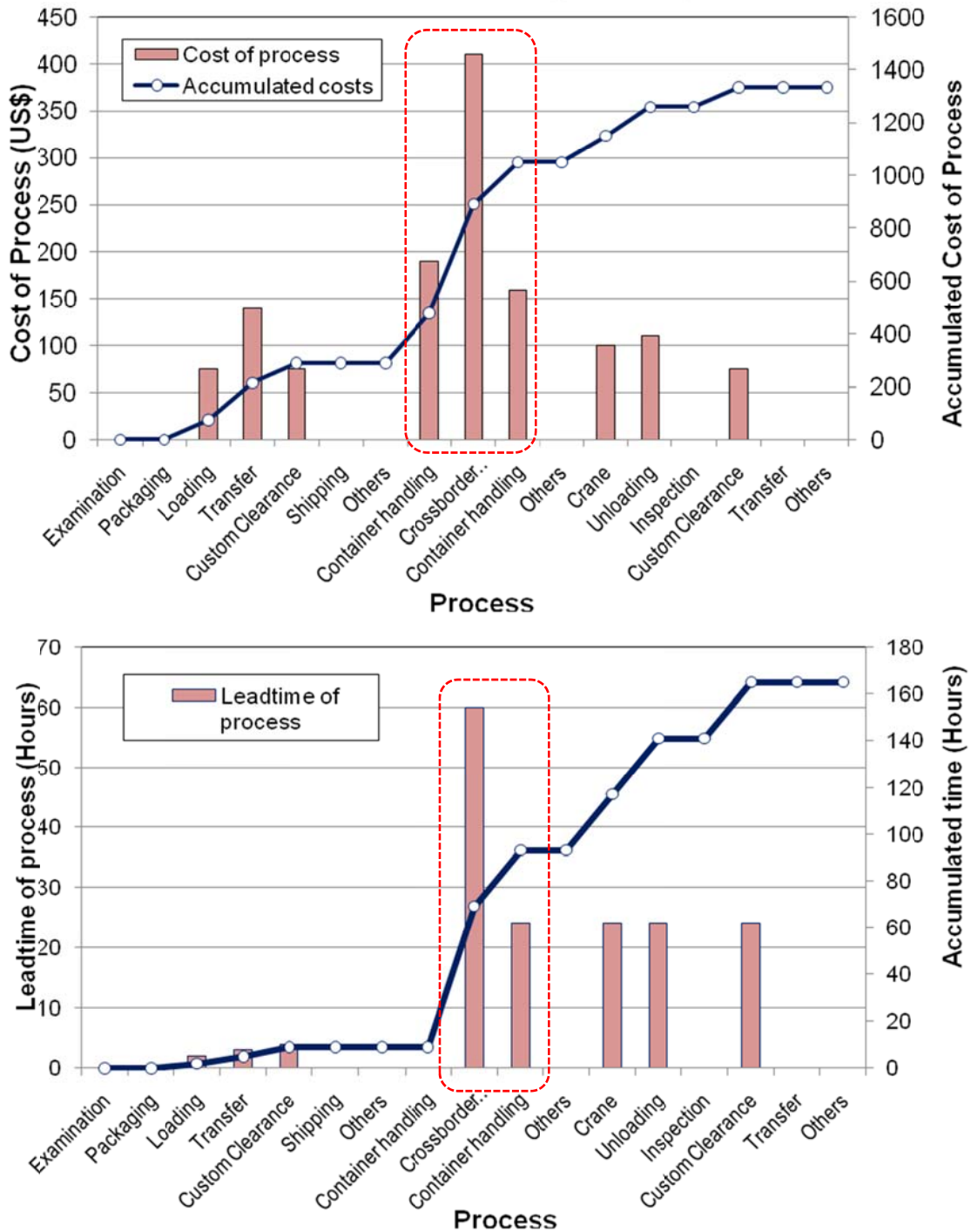
In Thailand, the State Railway of Thailand (SRT) is upgrading its 6km track from Aranyaprathet to Klongluk to prepare for the international traffic. In Cambodia, the missing link from Sisophon to Poipet has been under construction since the end of December 2010.

A feasibility study on the missing link section between Phnom Penh and the Cambodia/Vietnam border was completed in March 2011 with the assistance of China. Toward the implementation, Cambodia is planning to seek assistance both from development partners and investment from the private sector. The missing link between Loc Ninh and Ho Chi Min City is targeted to be completed by 2020, five years after the targeted year of completion of the corresponding missing link in Cambodia. After the adoption of the BAP/ASTP and the MPAC, however, Vietnam has upgraded this project as one of its priority projects, and has been seeking funding from development partners and private sectors for the construction.

4. Transport Facilitation

Although it is necessary to enhance physical connectivity by road or railway networks, this is not sufficient of itself to achieve the goals of the AEC, such as creating an ASEAN single market and production base and narrowing the development gaps. For example, as cross border transportation by trucks is usually not allowed, unloading and reloading processes are required at national borders. Land transportation sometimes requires transit transport in a third country between the country of origin and the country of destination. In the absence of an agreement on transit transport, logistic service providers need to go through customs procedures four times, to go out from originating country, enter a third country, go out from the third country, and enter the destination country. As illustrated in Figure 4, the costs and time for border-crossing are found to be significant, indicating that the expected impacts of transport facilitation are significant as well.

Figure 4: Cost and time for cross border transportation by trucks



Source: JETRO, ASEAN Logistic Network Map (2008).

In addition, international transport services often involve multiple modes of transportation such as trucks, railways, ships and airplanes. In order to facilitate international trade it is, therefore, important to have a common understanding on the legal liability of multimodal logistic service providers who provide integrated logistic services using multiple modes of transportation. Based on these premises, the Member

States have signed three framework agreements on transport facilitation, in an effort to fully bring these agreements into operation by 2015.

The AFAFGIT was signed in December 1998, with the objective of mutually allowing transit transport among ASEAN Member States. As stipulated in Article 4 of the AFAFGIT, “goods carried in sealed road vehicles, a combination of vehicles, or a container shall not be subjected to examination at Customs offices en route” except for exceptional cases “to prevent abuses such as smuggling and fraud” or “when irregularity is suspected.” A significant reduction in time and costs is therefore expected. The AFAFGIT consists of the main text and nine protocols; (1) designation of Transit Transport Routes and facilities, (2) designation of frontier posts, (3) types and quantity of road vehicles, (4) technical requirements of vehicles, (5) ASEAN scheme of compulsory motor vehicle third-party liability insurance, (6) railways border and interchange stations, (7) customs transit system, (8) sanitary and phytosanitary measures, and (9) dangerous goods.

The ASEAN Framework Agreement on Multimodal Transport (AFAMT) was signed in November 2005, to determine the legal liability of multimodal transport operators and consigners, and to agree on the standard format of multimodal transport contracts. The AFAMT applies for international multimodal transport services from or to ASEAN countries provided by multimodal transport operators officially registered in a Member State. Each Member State therefore effectively required enacting domestic legislation on multimodal transport as stipulated in the strategic schedule of the AEC Blueprint.

The ASEAN Framework Agreement on the Facilitation of Inter-State Transport (AFAFIST) was signed in December 2009, with the objective of allowing transport operators registered in a Member State to provide transport services in other Member States when the goods are transported from or to the country of registration. Together with the AFAFGIT, the AFAFIST is expected to increase significantly the efficiency of transit transport as there would be no need to unload and reload the goods at national borders. The AFAFIST shares the nine protocols with the AFAFGIT. Although the number of vehicles allowed to operate in other Member States was limited to 60 in the original text of the Protocol 3, it was increased to 500 to reflect the high expectation of growing intra-ASEAN trade.

The AEC Blueprint followed the ATAP, then the working five-year plan of transport cooperation prior to the BAP/ASTP, in setting the timelines for the implementation of these transport facilitation agreements. The AFAFGIT was planned to be implemented by 2009, contingent on the speedy conclusion of Protocol 2 (designation of frontier posts) and Protocol 7 (customs transit system). Protocol 6 (railways border and interchange stations) has been signed in 2011 and is waiting for ratification process by the Member States. As for the AFAMT, ASEAN Member States mandated themselves to have enacted necessary domestic legislations by 2009, as a prerequisite of implementing the agreement. The AFAMT was planned to be implemented at least in two Member States by 2011, and the ASEAN-wide implementation was to be complete by 2013. The main text of the AFAFIST was planned to be finalized and adopted by 2009 and the

implementation was to be started by 2011 toward ASEAN-wide implementation by 2015.

5. Marine Transport

As ASEAN consists of continental and archipelagic parts, the establishment of an integrated, efficient, and competitive maritime market is as important as having a well-developed highway network, as envisaged in the AHN. Maritime transport cooperation in ASEAN has been carried out along the Roadmap towards an Integrated and Competitive Maritime Transport in ASEAN (RICMTA), adopted at the 13th ATM in November 2007, for the purpose of promoting the progressive liberalization of maritime transport services in ASEAN.

The only specific action for maritime transport cooperation agreed in the AEC Blueprint is to implement the RICMTA. Among a number of concrete measures agreed in the RICTMA, the AEC Blueprint highlighted the need to develop strategies for an ASEAN Single Shipping Market (ASSM) by 2009.

RICMTA measure No.12 is to develop the strategies for an ASSM by December 2009, and No.13 is to implement the ASSM by December 2011. Indonesia, as the Lead Coordinator for measure No.12, drafted a strategy paper for an ASSM, which was subsequently adopted by the ASEAN Maritime Transport Working Group (MTWG) on 28 October 2010, with 10 months delay from the timeline. In view of the delay, the MPAC revised the timeline for the establishment of the ASSM to finalize the development of strategies by 2012 for an ASSM and develop the relevant framework for its implementation no later than 2015. The MPAC also listed a study on the Roll-on/Roll-off (RoRo) network and short-sea shipping as one of the prioritized projects, based on the BAP. Based on the ASEAN-Japan Plan of Action 2011-2015, adopted in December 2011, the Japan International Cooperation Agency (JICA) conducted a feasibility study in the fiscal year 2012 ending in March 2013. The initial phase of this study surveyed eight potential RoRo routes, which are (1) Zamboanga City – Muara; (2) Davao City – General Santos – Bitung; (3) Johor – Sintete; (4) Tawau – Tarakan – Pantoloan; (5) Brooke's Point – Labuan – Muara; (6) Dumai – Malacca; (7) Belawan – Penang; and (8) Phuket – Belawan. This study is expected to produce a practical implementation plan to establish international RoRo routes, which in turn would contribute to enhancing the connectivity of the archipelagic regions among themselves and with the continental part of ASEAN.

6. Air Transport

The ASEAN Open Sky Policy has been regarded as an integral element for achievement of the goals of the AEC. Experiences in ASEAN and other part of the world show that open sky policies could reduce airfares and increase convenience in terms of the number of flights and seats for passengers. This would significantly contribute to increasing international trade in goods and services and to enhancing people-to-people connectivity within ASEAN and with other parts of the world. However, the initiatives should not only be convenience-oriented, but should also pay

enough attention to the issues related to safety, security, and environmentally-friendly aviation in accordance with the globally acceptable standards.

Since the AEC Blueprint listed the ASEAN Open Sky Policy (along with the Roadmap for Integration of the Air Travel Sector: RIATS) and the ASEAN Single Aviation Market (ASAM), these have been on the central agenda of ASEAN's cooperation in air transport.

In accordance with the RIATS, the strategic schedule attached to the AEC Blueprint provides the timelines for implementation of the Multilateral Agreement on the Full Liberalization of Air Freight Services (MAFLAFS) by 2008 and the Multilateral Agreement on Air Services (MAAS) by 2010, which are two core measures under the RIATS. The strategic schedule also prescribed the steps toward establishing the ASAM as follows: the concept of the implementation framework for the ASAM and its Roadmap to be formulated by 2009 and adopted by ASEAN Transport Ministers by 2011; and the enabling implementation framework agreement for the ASAM to be developed by 2015.

To phase in further liberalization of air services in the region, the ASEAN Multilateral Agreement on the Full Liberalization of Passenger Air Services (MAFLPAS) was developed and concluded by 2010.

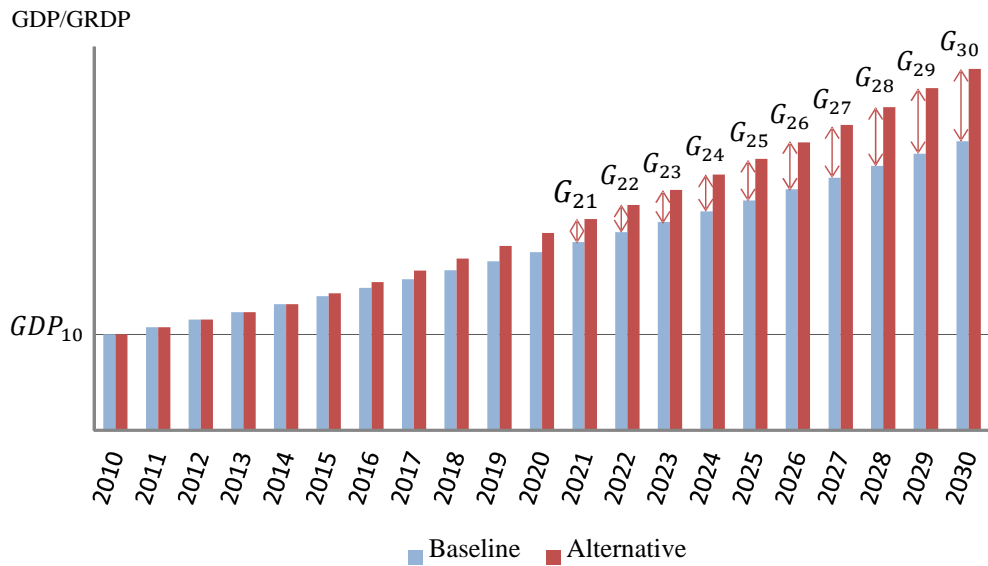
The RIATS agreements and their protocols were signed on 20 May 2009, and the MAFLAFS has already entered into force with nine AMSs, except for Indonesia which has ratified neither the main text nor its protocols, under the ASEAN-X formula.

7. Geographic Simulation Analysis

7.1. Baseline Scenario and Alternative Scenarios

We conduct simulation analysis by IDE-GSM to estimate potential impacts of MPAC prioritized projects. We take the differences of GDPs/Regional GDPs (GRDPs) between the baseline scenario and an alternative scenario (Figure 5) to calculate the economic impacts of prioritized projects in MPAC. The baseline scenario contains minimal additional infrastructure development by 2015. The alternative scenarios contain specific policy measures. We compare the GDPs or GRDPs between two scenarios typically at 2030. If the GRDP of a region under the scenario with specific trade and transport facilitation measures (TTFMs) is higher (lower) than that under the baseline scenario, we regard this surplus (deficit) as the positive (negative) economic impacts by the TTFMs.

Figure 5 Economic Impacts in percentage



$$\text{Economic Impacts} = \frac{\sum_{y=21}^{30} G_y}{GDP_{10}}$$

Source: Authors.

The following assumptions are maintained in the all scenarios, if not specified in a specific scenario:

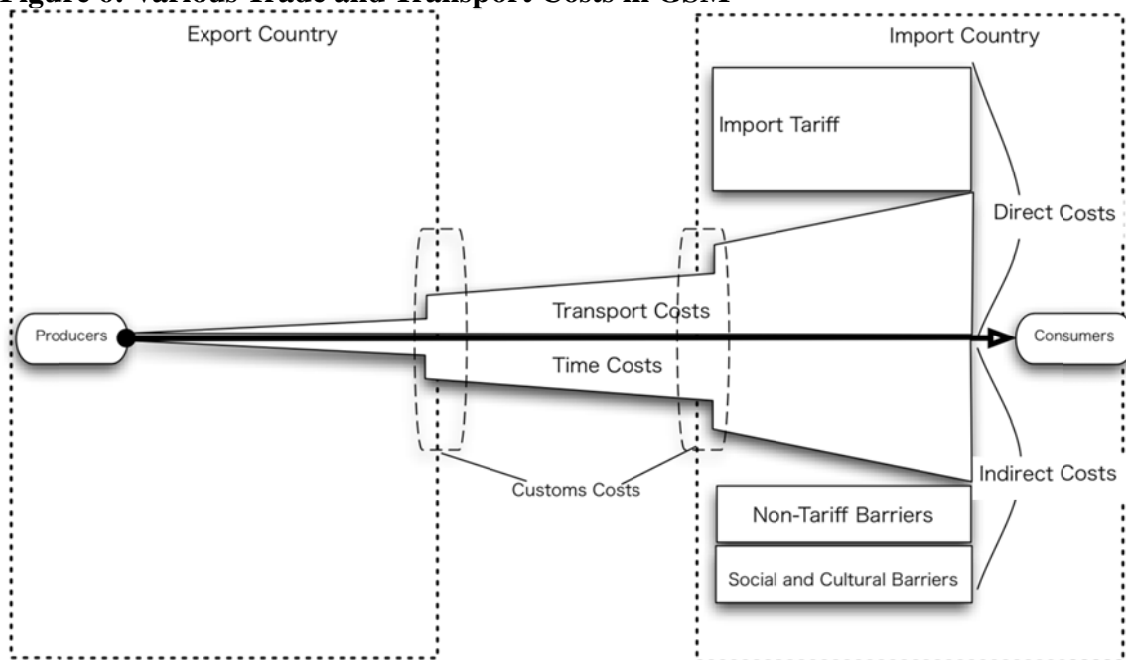
- National population of each country is assumed to increase at the rate forecast by the UN Population Division until year 2025.
- International migration is prohibited.
- Tariffs, non-tariff barriers and services barriers are changing on the basis of FTA/EPAs currently in effect.
- We give different exogenous growth rates on technological parameters for each country to calibrate the GDP growth trend from 2005 to 2010.

It should be noted that even if a region has a negative economic impact by TTFMs, it does not mean that region worsens off compared with the current situation. Most of the region in East Asia are expected to growth faster for a few decades, and the negative economic impacts offsets a part of the gains of the expected economic growth.

In our simulation model, we have various factors of broadly defined transport costs as shown in Figure 6. We calculate physical monetary costs for shipping. We assume that firms will incur some time costs as well as monetary costs. At the land national borders, international ports and international airports, trucks, vessels and airplanes need some additional time and firms must pay some transaction costs. Import tariffs are levied in importing. In addition to those costs, we also estimate some “behind the border” related costs, that is, non-tariff barriers and social and cultural barriers. They are essential for our model to describe difficulties in trade, such as finding trade partners,

studying export and import procedures, preparing and declaring documents before shipping starts, getting accustomed with trade operations, and promoting the products or services to the customers in other countries.

Figure 6: Various Trade and Transport Costs in GSM



Source: Authors.

7.2. “All MPAC Projects” Scenario

First, we present a scenario with combination of major MPAC prioritized projects. In each scenario, we have a combination of different types of trade-and transport facilitation measures, that is,

- Road development and improvement which provides a new road section or reduces time at the specific road section in the model
- Railway development and improvement which provides a new rail section or reduces time at the specific rail section in the model
- Sea route establishment and enhancement, which provides a new sea section or reduces time at the specific sea section in the model
- Port construction and upgrade which reduces time and costs at loading, unloading and transshipping goods at the port and prevent congestion
- Airport upgrade which reduces time and costs at loading, unloading and transshipping goods at the airport and prevent congestion
- Border post upgrade and border facilitation which reduces time and costs for passing the border and prevent congestion
- SEZ development which raises the productivity parameter of the specific region in

the model, and

- NTB reduction where NTB in manufacturing and services sector in the specific economy is lowered

We specify the scenario as follows:

“All MPAC Projects” Scenario

(1) Upgrading “Below Class III’ Sections in 2015

	AHN Projects in the AEC Blueprint	Simulation Scenario
AH2	Improvement of Below Class III section (457km) out of total stretch connecting Meikthila, Loilem and Kyaington (643km).	Increase the average speed of transportation between Meikthila and Kyaington (643km) from 19.25km/h to 38.5km/h.
AH1(1)	Improvement of Below Class III section (195km) connecting Thaton and Myawaddy.	Increase the average speed of transportation between Thaton and Myawaddy (195km) from 19.25km/h (Section between Thaton to Kawkareik) or 4km/h (Section between Kawkareik and Myawaddy) to 38.5km/h.
AH1(2)	Improvement of Below Class III section (379km) connecting Chaung-U and Kalemyo.	Increase the average speed of transportation between Chaung-U and Kalemyo (379km) from 19.25km/h to 38.5km/h.

(2) Developing Missing Links of AHN in 2015

	AHN Projects in the AEC Blueprint	Simulation Scenario
AH112	Development of the missing link section (60km) to connect Lehnya and Khongloy.	Add a new road link connecting Lehnya and Khongloy (60km) to 38.5km/h.
AH123	Development of the missing link section (141km) to connect Dawei and Maesamepass.	Add a new road link connecting Dawei and Kanchanaburi (211km), with an average speed of 38.5km/h.

(3) Developing Missing Links of SKRL⁴ in 2015

Aranyaprathet – Klongluk (Thailand) (6km) in 2015.

Poipet – Sisophon (Cambodia) (48km) in 2015.

Phnom Penh – Loc Ninh (Cambodia) (255km) in 2015.

Loc Ninh – Ho Chi Minh City (Vietnam) (129 km) in 2020

(4) Border Facilitation in 2015

- 50% reduction in time and costs at the 34 borders along the AHN.

	AH No.	TTR	Border Checkpoints	
1	AH-1	TTR	Moreh (India)	Tamu (Myanmar)
2	AH-1	TTR	Myawaddy (Myanmar)	Mae Sot (Thailand)
3	AH-1	TTR	Khlong Luek (Thailand)	Poipet (Cambodia)
4	AH-1	TTR	Bavet (Cambodia)	Moc Bai (Vietnam)
5	AH-1		Huu Nghi Quan (Vietnam)	Youyiguan (China)
6	AH-2	TTR	Tachileik (Myanmar)	Mae Sai (Thailand)
7	AH-2	TTR	Sadao (Thailand)	Bukit Kayu Hitam (Malaysia)
8	AH-2		Johor Bharu (Malaysia)	Woodland (Singapore)
9	AH-3	TTR	Mohan (China)	Boten (Lao PDR)
10	AH-3	TTR	Houi Sai (Lao PDR)	Chiang Khong (Thailand)

⁴ Although it is difficult to think that Phnom Penh–Loc Ninh section will be completed by 2015, we tentatively assumed the completion year as stated in MPAC.

11	AH-3		Daluo (China)	Mongla (Myanmar)
12	AH-11	TTR	Trapeing Kreal (Cambodia)	Veunkhame (Lao PDR)
13	AH-12		Thanaleng (Lao PDR)	Nong Khai (Thailand)
14	AH-13		Tay Trang (Vietnam)	Taichang (Lao PDR)
15	AH-13		Muang Ngeun (Lao PDR)	Huai Kon (Thailand)
16	AH-14	TTR	Muse (Myanmar)	Ruili (China)
17	AH-14		Hekou (China)	Lao Cai (Vietnam)
18	AH-15		Nakhon Phanom (Thailand)	Thakek (Lao PDR)
19	AH-15	TTR	Namphao (Lao PDR)	Keo Nua (Vietnam)
20	AH-16	TTR	Mukdahan (Thailand)	Savannakhet (Lao PDR)
21	AH-16	TTR	Danesavanh (Lao PDR)	Lao Bao (Vietnam)
22	AH-18		Sungai Kolok (Thailand)	Rantau Panjang (Malaysia)
23	AH-112		Khong Loy (Myanmar)	Bang Saphan (Thailand)
24	AH-123		Maesamepass (Myanmar)	Kanchanaburi (Thailand)
25	AH-123		Hat Lek (Thailand)	Cham Yeam (Cambodia)
26	AH-131		Kiamuoya (Lao PDR)	Mu Da (Vietnam)
27	AH-132		Ban Het (Lao PDR)	Bo Y (Vietnam)
28	AH-143		Johor Bharu (Malaysia)	Tuas (Singapore)
29	AH-150	TTR	Entikong (Indonesia)	Tebedu (Malaysia)
30	AH-150	TTR	Miri (Malaysia)	Sungai Tujoh (Brunei)
31	AH-150	TTR	Kuala Lurah (Brunei)	Limbang (Malaysia)
32	AH-150	TTR	Limbang (Malaysia)	Puni (Brunei)
33	AH-150	TTR	Labu (Brunei)	Lawas (Malaysia)
34	AH-150		Serudong (Malaysia)	Simangaris (Indonesia)

(5) Developing RoRo Routes in 2015

RoRo1: Zamboanga City (Philippines) – Muara (Brunei)

RoRo2: Davao City – General Santos (Philippines) – Bitung (Indonesia)

RoRo3: Johor (Malaysia) – Sintete (Indonesia)

RoRo4: Tawau (Malaysia) - Tarakan (Indonesia) – Pantoloan (Indonesia);

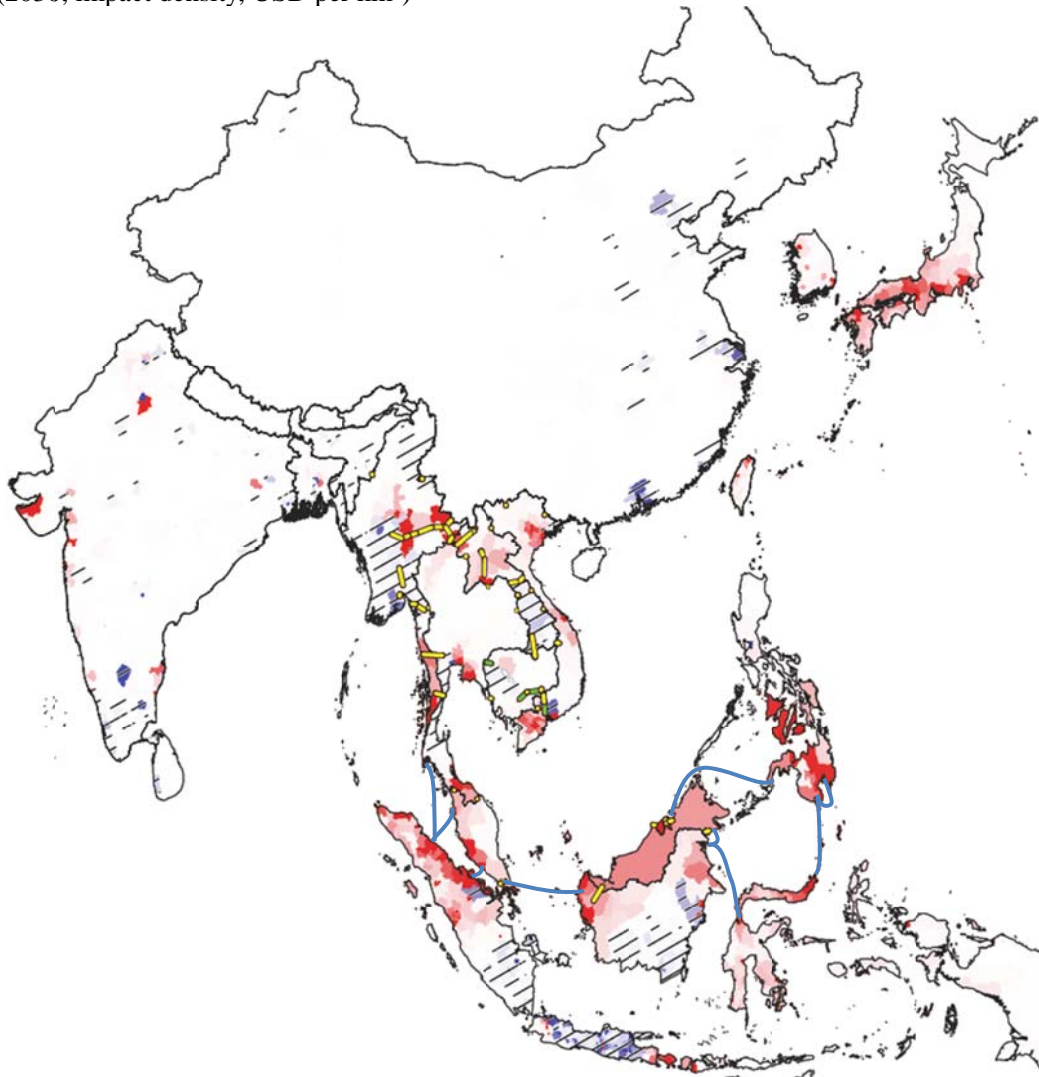
RoRo5: Dumai (Indonesia) – Malacca (Malaysia)

RoRo6: Belawan (Indonesia) – Penang (Malaysia)

RoRo7: Phuket (Thailand) – Belawan (Indonesia)

Figure 7 illustrates the result of the scenario. Red regions will have positive impacts and blue regions will have negative impacts. We use a criterion of “impact density”, which is derived by dividing a GRDP difference between the baseline scenario and a development scenario by the land size of the region. The thicker red color (blue color) a region has, the higher positive impact (negative impact) one square kilometer of land of the region will see with a development scenario. Combination of the MPAC prioritized projects brings positive economic impact on GDP of ASEAN member states while they are relatively small. In total, ASEAN will have a 6.8% increment of GDP in 10 years from 2021 to 2030 compared with the GDP in 2010 as shown in Figure 5.

Figure 7: Economic Impacts of “All MPAC Projects” on GRDP/GDP
(2030, impact density, USD per km²)



Note: Not available (NA) for North Korea, Timor-Leste, and Jammu and Kashmir due to data availability.

Source: IDE-GSM simulation result.

7.3. Limitation of the MPAC prioritized projects

The result of the simulation on the MPAC prioritized projects, which is depicted in Figure 7, showed that they will bring positive impacts on ASEAN member states while the positive impacts will not be distributed to most regions in ASEAN. In particular, Yangon and surrounding regions and northern regions in Myanmar, southern provinces in Laos, and southern part of Kalimantan and Sumatra, and most regencies in Java Island will have negative impacts compared with the baseline scenario.

There are mainly three limitations resulting in limited positive impacts of the MPAC prioritized projects. First, the MPAC projects mainly include the infrastructure projects connecting ASEAN member states while each ASEAN member state has a long

list of domestic infrastructure projects. It indicates that most projects connect a remote area from the largest economic city in one ASEAN member state and a remote area of another ASEAN member state. Those projects positively affect the area close to the project site, while they do not benefit other areas. Moreover, those projects may prevent inflow of household and firms from remote areas to largest economic cities compared with the baseline scenario and may slow down the economic development of the country by preventing the formation of the economic cluster near the largest economic cities. Second, the projects do not include the projects connecting one ASEAN member state and surrounding non-ASEAN member state. Third, the project list has not revised and thus they do not include new projects such as high speed rail projects in Malaysia-Singapore, Thailand, and Indonesia.

7.4. CADP Projects

We have 8 economic corridor development and sub-regional development scenarios, that is, the Mekong-India Economic Corridor (MIEC), the GMS East-West Economic Corridor (EWEC), the GMS North-South Economic Corridor (NSEC), development in the Indonesia-Malaysia-Thailand Growth Triangle (IMT), broader development in the IMT and surrounding regions (IMT Plus), development in the Brunei Darussalam-Indonesia-Malaysia-The Philippines East ASEAN Growth Area (BIMP), broader development in the BIMP and surrounding regions (BIMP Plus), and development in the Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC). We have 4 sectoral development scenarios, that is, all infrastructure development (All Infra.), NTB reduction (NTB), SEZ development in Cambodia, Lao PDR, Myanmar and Vietnam (SEZ), and combination of those three sectoral development scenarios (All-All). The impacts of all scenarios are summarized in the Table 2.

Table 2: Grand Table: Economic Impacts in ten years cumulation (2021-2030, %)

Economy	All Infra.	NTB	SEZ	All-All
Australia	1.28%	0.84%	-0.04%	2.10%
Bangladesh	11.51%	8.48%	0.02%	20.56%
Bhutan	104.90%	4.75%	-0.01%	109.81%
Brunei	5.32%	82.07%	-0.12%	88.33%
Cambodia	24.86%	8.44%	125.39%	160.30%
China	0.10%	7.74%	0.02%	7.99%
Hong Kong	1.63%	0.31%	-0.05%	1.89%
India	6.59%	12.21%	-0.01%	19.28%
Indonesia	91.87%	25.86%	0.03%	118.50%
Japan	1.39%	1.29%	-0.03%	2.67%
Korea	1.74%	2.44%	-0.03%	4.17%
Laos	61.85%	12.85%	79.06%	156.58%
Macao	3.97%	0.96%	-0.12%	4.82%
Malaysia	3.46%	54.36%	-0.01%	58.55%
Myanmar	89.19%	25.35%	70.54%	193.82%
Nepal	6.10%	8.33%	0.00%	14.69%
New Zealand	1.29%	0.28%	-0.06%	1.52%
Philippines	13.76%	25.10%	0.03%	39.82%
Singapore	7.86%	6.06%	-0.11%	13.92%
Sri Lanka	8.20%	29.30%	0.02%	40.82%
Taiwan	1.80%	1.79%	-0.04%	3.57%
Thailand	7.86%	41.68%	0.02%	51.58%
Vietnam	17.14%	47.47%	56.86%	124.81%
ASEAN	42.08%	31.19%	6.33%	80.87%
EAS 16	5.87%	7.76%	0.67%	14.55%

Source: IDE/ERIA-GSM simulation result.

CADP Project

(a) All Infrastructures Scenario

(1) MIEC

Year	Scenario
2020	<ul style="list-style-type: none"> (1) Road Improvement along National Road No. 5 and 1 in Cambodia (2) Road Improvement between Moc Bai and Cai Mep Port in Vietnam (3) Road Improvement between Kanchanaburi and Dawei Port (4) Connecting Dawei and Chittagong, Dawei and Kolkata, Dawei and Visakhapatnam, Dawei and Chennai, and Dawei and Colombo by sea routes equivalent to internationally important routes (5) Border facilitation at borders between Poipet and Aranyaprathet, Bavet and Moc Bai, and Phu Nam Ron and Thiki

(2) EWEC

Year	Scenario
2020	<ol style="list-style-type: none">(1) Road Improvement between Da Nang to Lao Bao in Veitnam(2) Road Improvement between Densavanh to Kaysone Phomvihane in Laos(3) Road Improvement between Kawkareik to Yangon in Myanmar(4) Border facilitation at borders between Myawaddy and Mae Sot, Mukdahan and Kaysone Phomvihane (Savannakhet), and Densavanh and Lao Bao

(3) NSEC

Year	Scenario
2020	<ol style="list-style-type: none">(1) Road Improvement between Tachileik to Daluo in Myanmar(2) Road Improvement between Houayxay and Boten in Laos(3) Border facilitation at borders between Mae Sai and Tachileik, Daluo and Mong La, Chiang Khong and Houayxay, and Boten and Mohan

(3) IMT Plus

Year	Scenario
2020	<ol style="list-style-type: none">(1) Road Improvement along Trans-Sumatran Highway between Medan and Bakaheuni(2) KL-Singapore High Speed Rail Link(3) New RoRo route between Tanjung Pelepas and Sambas(4) New RoRo route between Malacca and Dumai(5) New RoRo route between Penang and Belawan and Phuket and Belawan

(4) BIMP Plus

Year	Scenario
2020	<ol style="list-style-type: none">(1) Road Improvement along Trans-Java Highway between Cirebon and Surabaya(2) Road Improvement along Pan-Philippine Highway between Laoag and Guiguinto, Santo Tomas and Matnog, Allen to Liloan, and Lipata and Ipil(3) New RoRo route along Davao-General Santos-Bitung(4) New RoRo route between Zamboanga and Muara(5) New RoRo route along Tawau-Tarakan-Palu(6) Sea route improvement between Manila and Singapore, Singapore and Jakarta, and Jakarta and Manila(7) Sea route improvement between Surabaya and Makassar(8) Sea route improvement between Surabaya and Balikpapan(9) Sea route improvement between Surabaya and Bitung(10) Jakarta-Bandung High Speed Railway

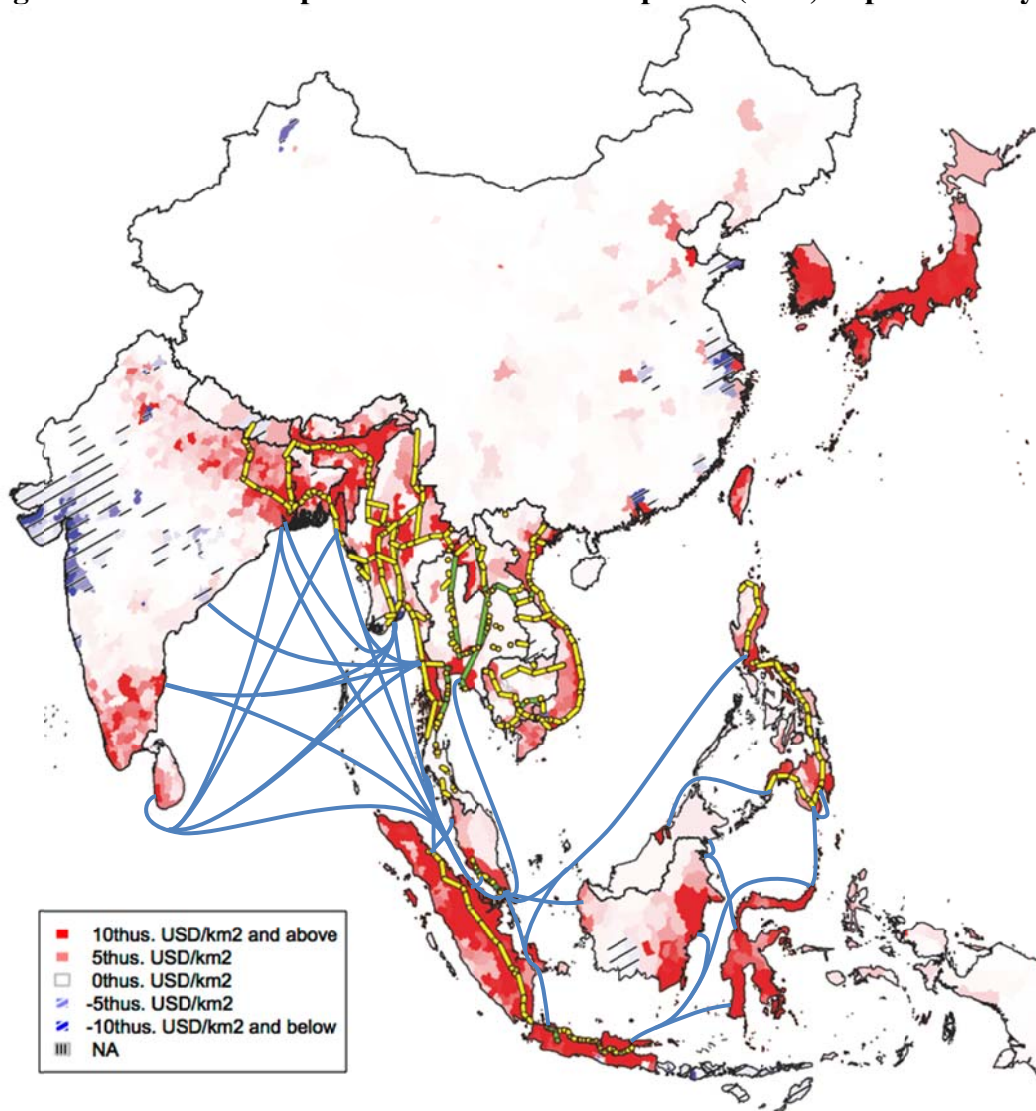
(5) BIMSTEC

Year	Scenario
2020	<ol style="list-style-type: none">(1) Road Improvement between Kawkareik and Yangon, and Payagyi and Tamu in Myanmar(2) Road Improvement between Moreh and Kolkata, Raxaul and Kolkata and Petrapole and Kolkata in India(3) Road Improvement between Benapole and Teknaf in Bangladesh(4) Road Improvement between Birgunj and Kathmandu in Nepal(5) Border facilitation at borders between Mae Sot and Myawaddy, Tamu and Moreh, Petrapole and Benapole, and Raxaul and Birgunj(6) Sea route improvement at selected routes:(7) Port Laem Chabang-Port Singapore(8) Port Singapore-Port Yangon(9) Port Chittagong-Port Singapore(10) Port Haldia-Port Singapore(11) Port Madras-Port Singapore(12) Port of Colombo-Port Singapore(13) Port Calcutta-Port Yangon(14) Port Yangon-Port Madras(15) Port Yangon-Port of Colombo(16) Port of Colombo-Port Haldia(17) Port of Colombo-Port Chittagong

(6) Others

Year	Scenario
2020	<ol style="list-style-type: none">(1) Domestic infrastructure development in Myanmar(2) Expressway construction between Hanoi and Ho Chi Minh City(3) High speed rail in Thailand(4) Border facilitation at ASEAN borders and for borders between ASEAN countries and surrounding countries.(5) Port and Airport expansion to prevent congestion in East Asia

Figure 8: Economic Impacts of All Infra. Development (2030, Impact Density)



Note: Not available (NA) for North Korea, Timor-Leste, and Jammu and Kashmir due to data availability.

Source: IDE/ERIA-GSM simulation result.

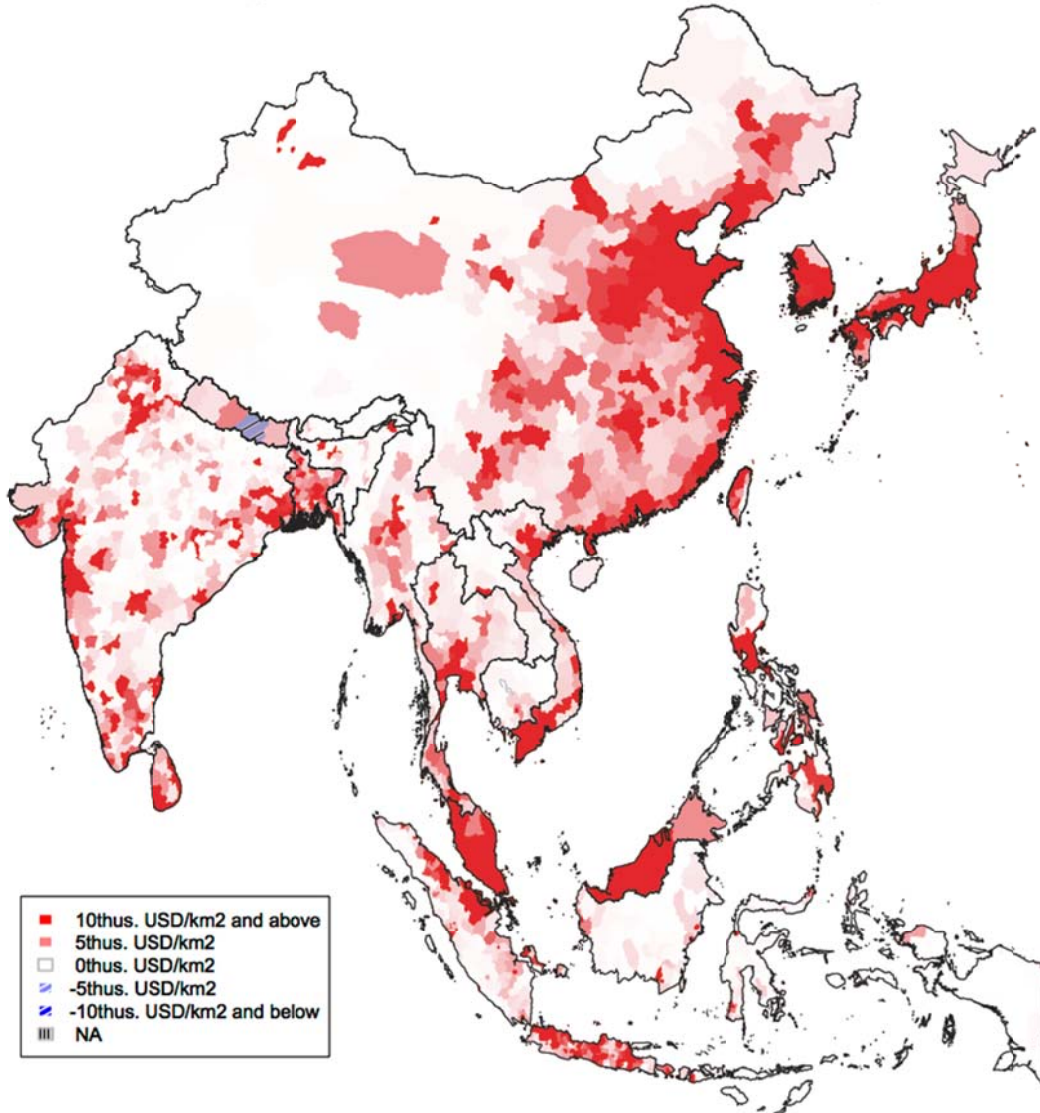
Figure 8 shows the economic impact of “All infrastructures” scenario. Kawthoung, Myanmar (2,020.06%), Tachileik, Myanmar (979.91%), and Dawei, Myanmar (869.97%) will be the gainers from this scenario. Those regions will benefit from being connected to other part or Myanmar by domestic corridor improvement and other countries by international corridor development.

(b) NTB Reduction Scenario

(1) Additional NTB reduction from 2016 to 2025 every year for selected countries:

Country	percent
Bangladesh	1.46%
Bhutan	2.12%
Brunei	2.18%
Cambodia	1.31%
China	1.69%
India	1.80%
Indonesia	1.97%
Laos	1.81%
Malaysia	1.44%
Myanmar	3.48%
Nepal	2.45%
Philippines	1.05%
Sri Lanka	1.42%
Thailand	1.30%
Vietnam	1.23%

Figure 9 Economic Impacts of NTB Reduction (2030, Impact Density)



Note: Not available (NA) for North Korea, Timor-Leste, and Jammu and Kashmir due to data availability.

Source: IDE/ERIA-GSM simulation result.

We assume an aggressive regulatory reform where the country gradually reduces NTB from 2016 to 2025 up to the level of a country which is 10 ranks better than the country in terms of the estimated NTB value among 185 economies. This assumption requires a drastic reform to the country to raise its competitiveness in the world to 10 ranks higher. It can only be achieved through combination of regional cooperation and each economy's own effort.

Most of the regions will have positive impacts from overall regulatory reforms. Top gainers will be Kota Lhokseumawe, Indonesia (283.77%), Dong Nai, Vietnam (135.98%) and Cilacap, Indonesia (135.78%).

(c) SEZ Scenario

(1) Productivity Improvement for specific SEZ sites in CLMV countries

By five percent in 2015:

- Ha Noi
- Ho Chi Minh
- Bien Hoa
- Hai Duong
- Sisophon
- Batdambang
- Phnom Penh
- Krong Preah Sihanouk
- Svay Rieng
- Ta Khmau
- Kaoh Kong
- Vientiane Capital
- Pakxanh
- Thakhek
- Khanthabuly
- Pakse

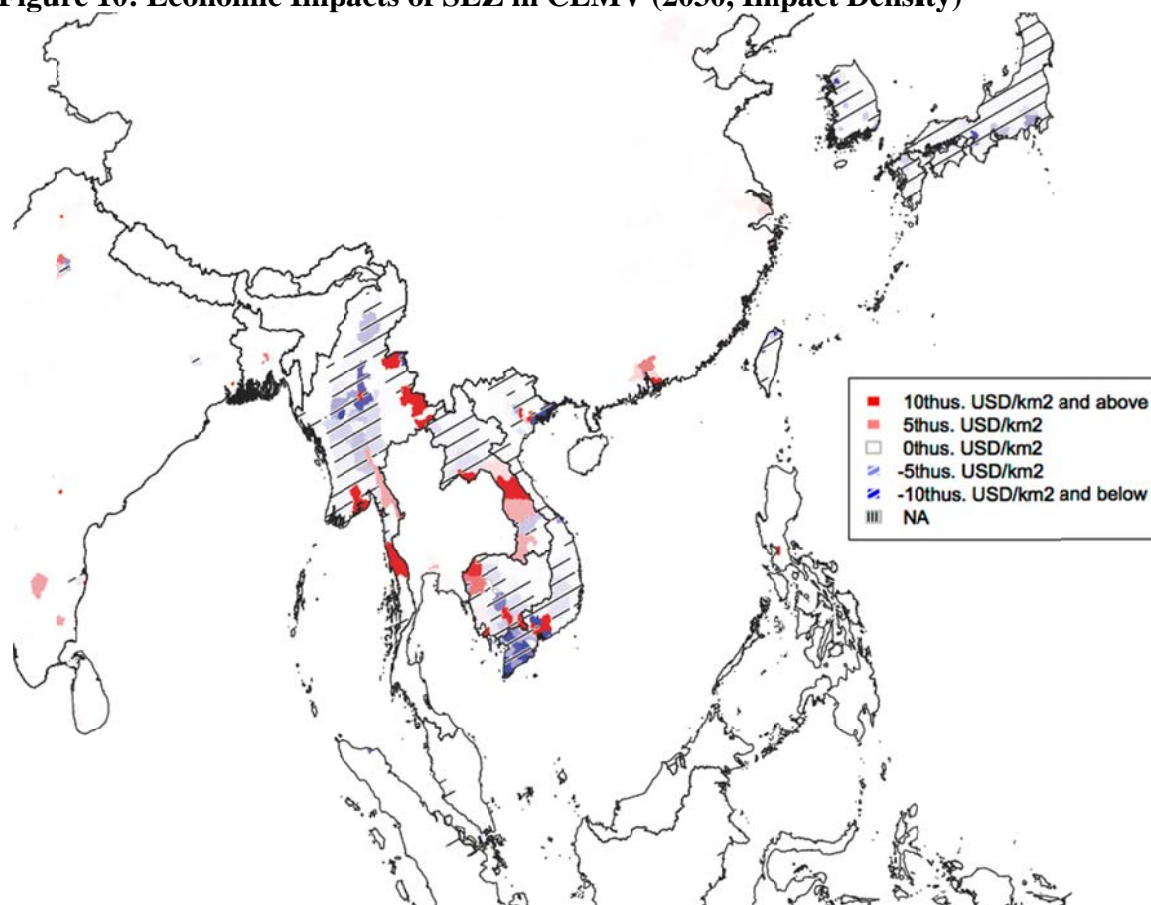
By five percent in 2020:

- Hpa-An
- Myawaddy
- Mandalay
- Muse
- Yangon
- Tachileik
- Kengtung
- Kyaukpyu

By 50 percent in 2020:

- Dawei

Figure 10: Economic Impacts of SEZ in CLMV (2030, Impact Density)



Note: Not available (NA) for North Korea, Timor-Leste, and Jammu and Kashmir due to data availability.

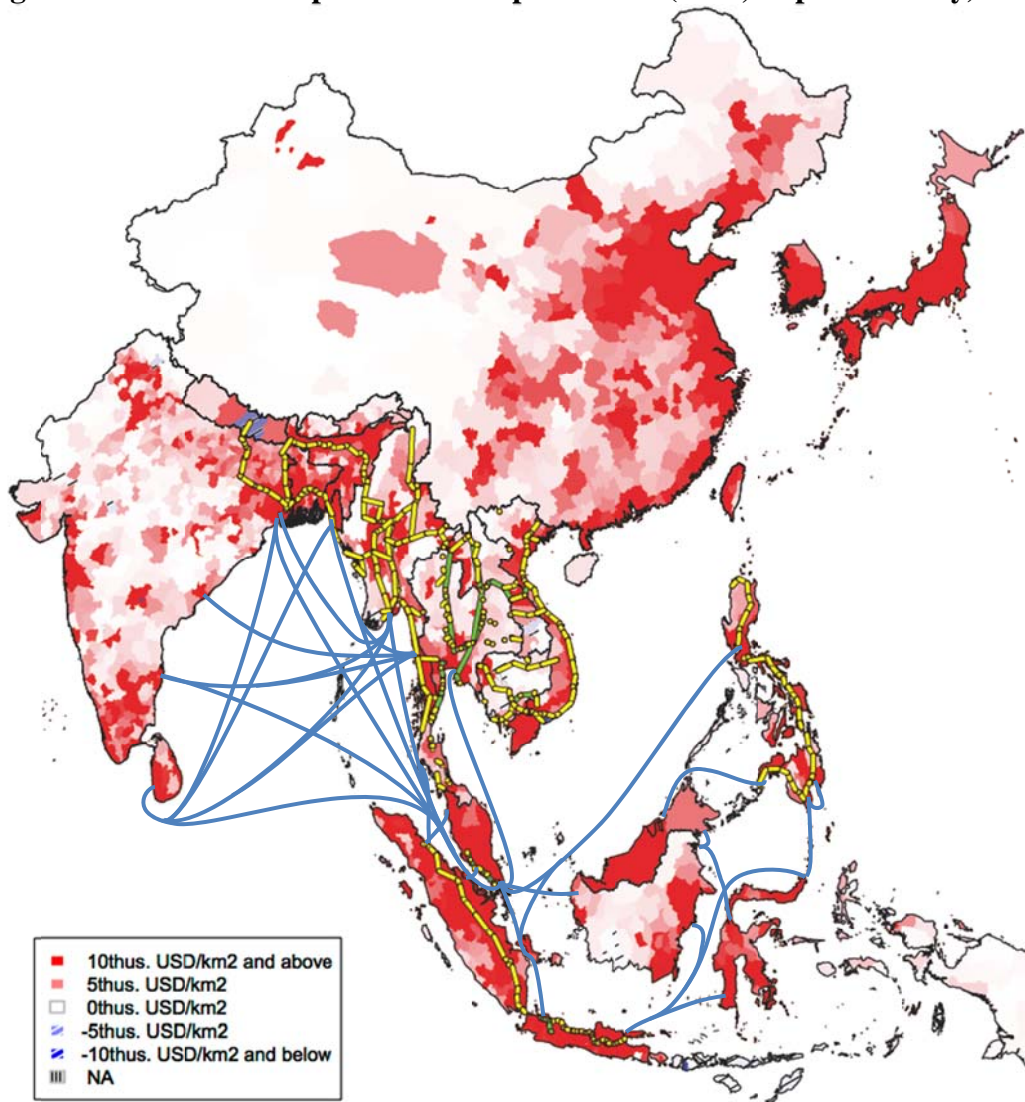
Source: IDE/ERIA-GSM simulation result.

As shown in the Figure 10, this scenario mainly benefits only the regions which have SEZ. Dawei, Myanmar (722.79%), Dong Nai, Vietnam (380.51%) and Phnom Penh, Cambodia (361.62%) will have largest impacts. Most of other regions in CLMV countries will have negative impacts compared with the baseline scenario in 2030.

(d) All

(1) All improvements of infrastructure, NTB reduction, and SEZ

Figure 11: Economic Impacts of All Improvement (2030, Impact Density)



Note: Not available (NA) for North Korea, Timor-Leste, and Jammu and Kashmir due to data availability.

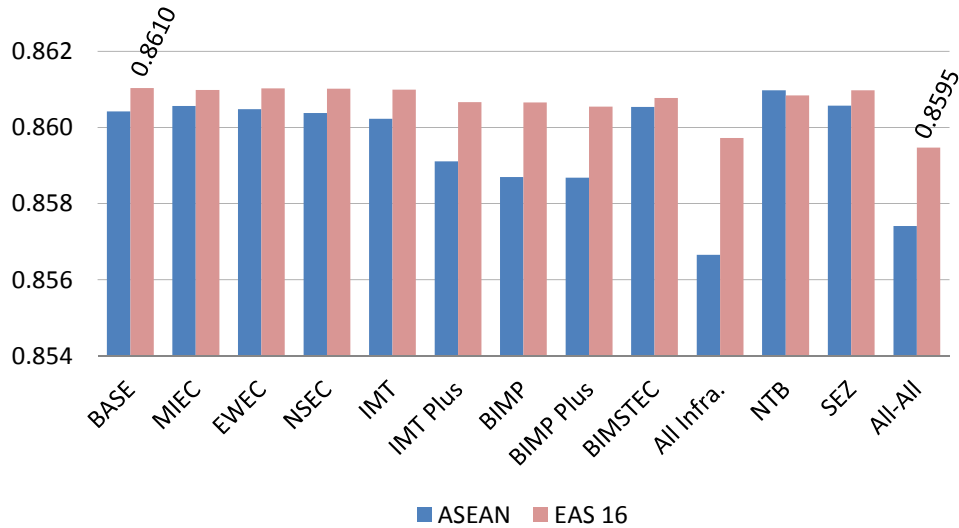
Source: IDE/ERIA-GSM simulation result.

The combination of the all improvements will give largest impacts on most of the regions. The top three gainers will be Dawei, Myanmar (2,163.71%), Kawthoung, Myanmar (2,026.38%) and Tachileik, Myanmar (1,336.46%)

7.5. Impacts on GINI and Traffic

Figure 12 shows the impacts of the each scenario on the spatial GINI of ASEAN and EAS 16 countries.

Figure 12: Economic Impacts on GINI (2030)



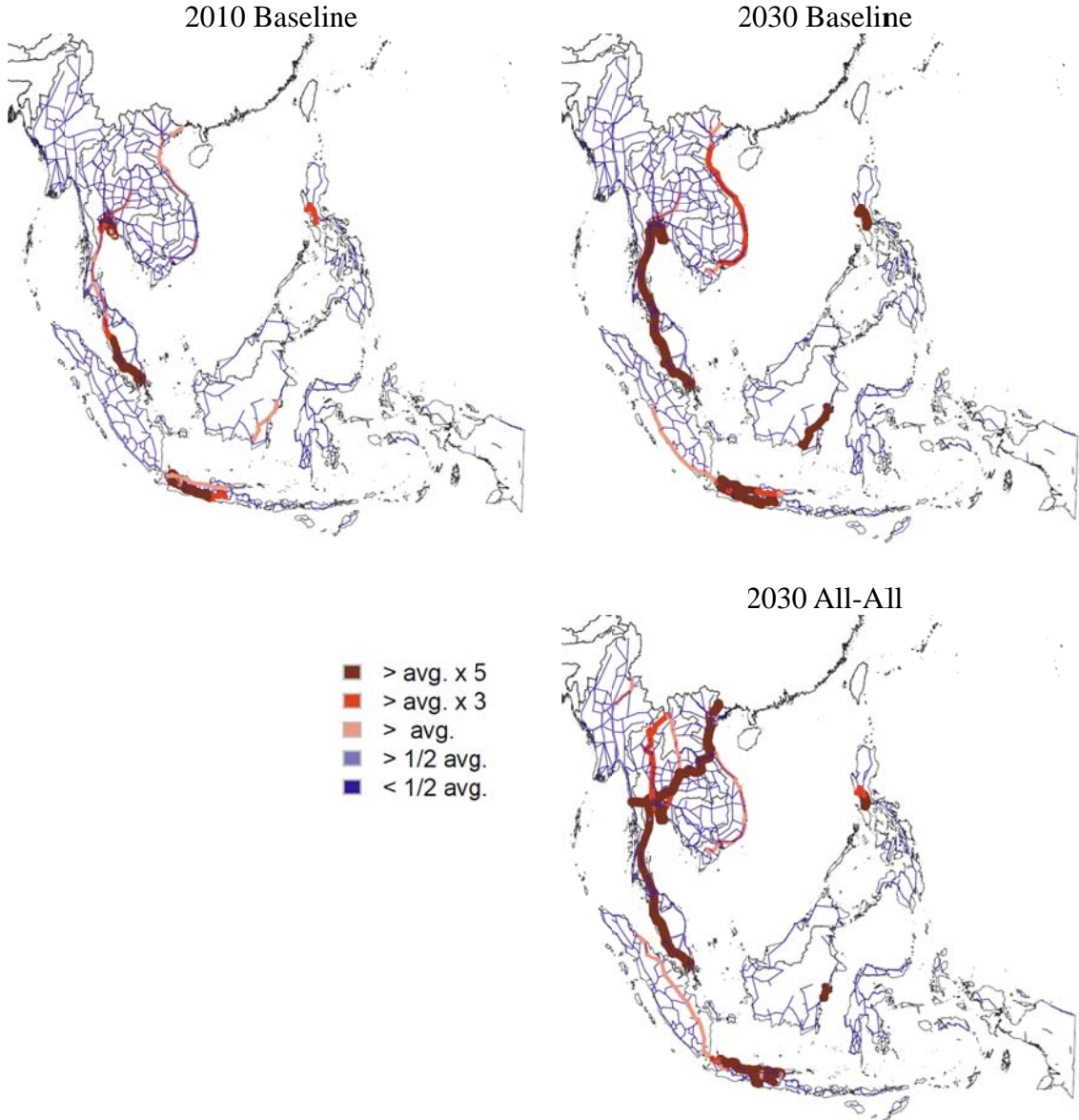
Source: IDE/ERIA-GSM simulation result.

Compared with the baseline scenario, all scenarios will reduce spatial GINI of EAS 16 countries, while MIEC, EWEC, BIMSTEC, NTB and SEZ scenarios will increase the GINI of ASEAN. “All-All” scenario will reduce GINI coefficients for both ASEAN and EAS 16. We find that BIMP, BIMP Plus and All Infrastructure scenarios have larger impacts on reducing GINI coefficients.

NTB reduction has relatively smaller impacts on GINI of EAS and worsens the GINI of ASEAN. It can be explained as that the regulatory reform will benefit large cities or existing clusters more than smaller cities or rural areas, although most of the regions will have positive impacts. This comparison of GINI coefficient informs that strategic infrastructure development can disperse and distribute the benefit toward smaller cities and rural areas.

Figures 13 and 14 see the traffic change for the intermediate goods of automotive industry and electronics and electric appliances (E&E) industry. If we do not have any infrastructure and other facilitation measures and go as in the baseline scenario, traffic volume will be enlarged relatively proportionally from 2010.

Figure 13: Traffic of Automotive Intermediate Goods in ASEAN

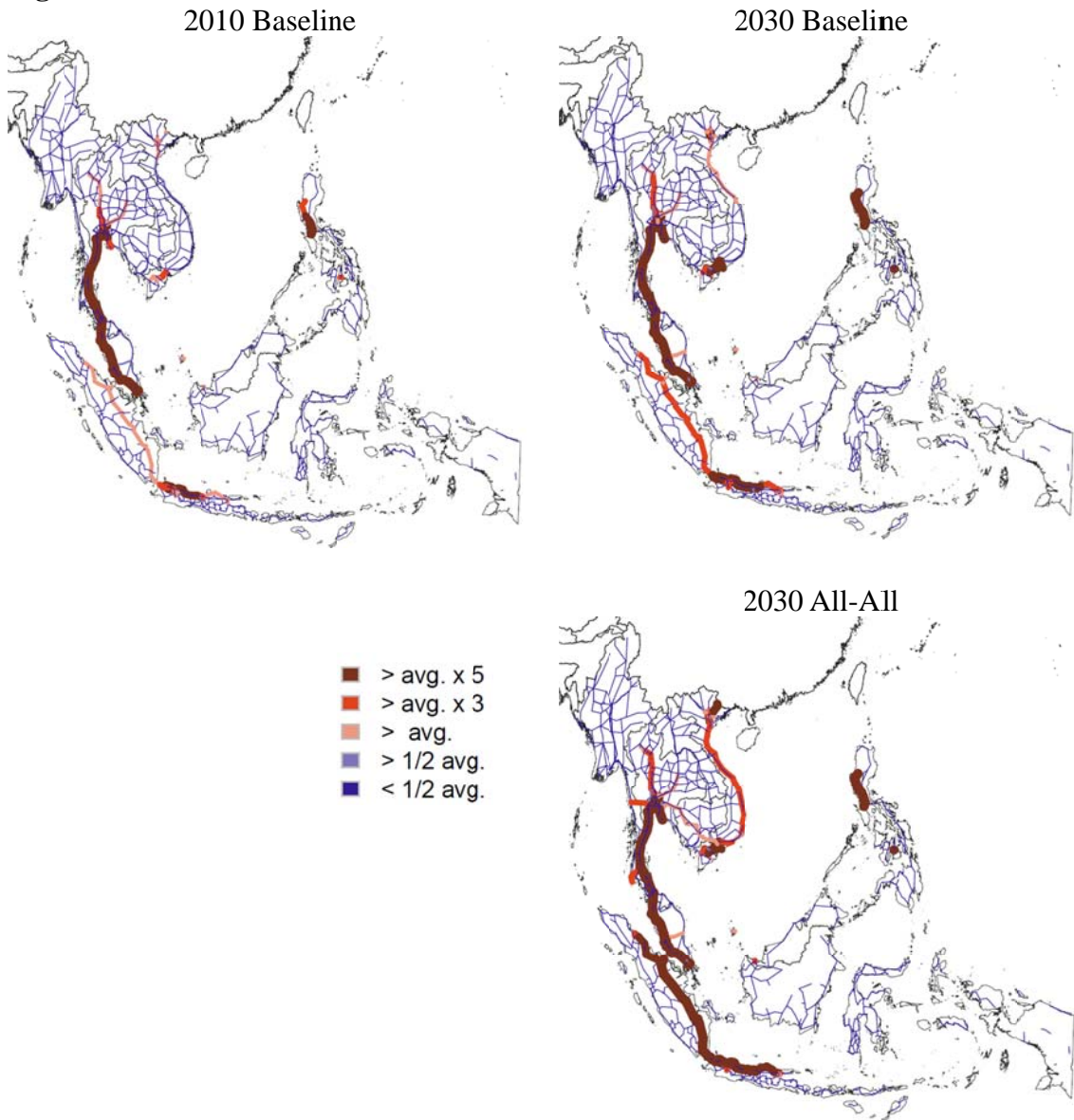


Note: For all three figures, *avg.* is average traffic volume of ASEAN in 2030 in the baseline scenario.

Source: IDE/ERIA-GSM simulation result.

However, if we have overall development as in the All-All scenario, we will see new transport corridor such as Hanoi-Bangkok-Dawei, NSEC, and Trans-Sumatran Highway. It implies that there are underlying demands for those corridors and we must provide sufficient capacity to meet the demand. At the same time, regions along the corridors can attract more firms and industries utilizing increasing transport demand.

Figure 14: Traffic of E&E Intermediate Goods in ASEAN



Source: IDE/ERIA-GSM simulation result.

8. Policy Recommendation

We conclude this paper with some policy implications of the simulation analysis. First, each connectivity project in the MPAC will bring certain positive impacts as the results of “All MPAC Projects” scenario presents. Regions connected with upgraded roads and new RoRo routes have positive economic impacts compared with the baseline scenario. Meanwhile, the geographic extension of the positive impacts from the projects may differ. Many projects on “Below Class III” and “Missing link” routes are mainly only of benefit to the limited areas along the routes. Regions along the roads upgraded and developed enjoy positive economic impacts while Yangon has some negative

impacts and the impacts on the other countries than Myanmar are negligible.

Second, we should be aware of the different characteristics of the projects. Some projects contribute to higher economic growth of a country and the region while some others benefit narrower development gaps. Facilitation at the borders brings positive impacts to Cambodian provinces near Thailand while the economic impact on GDP of Cambodia might be negative, because border areas attract more firms and households and economic agglomeration in Phnom Penh becomes smaller in the border facilitation scenario and smaller agglomeration in the capital city may impede faster economic growth of the country. We should strategically combine projects for higher economic growth and projects for narrowing development gaps. In fact, ASEAN projects or MPAC projects are not an entire set of transport infrastructure projects that ASEAN countries must implement. ASEAN Member States have domestic infrastructure projects, bilateral cooperation, and sub-regional initiatives. Strategic combination of the projects, such as expressway construction among main domestic cities, toll-way construction and provision of mass transit transport in urban areas, and upgrading of gateway ports should be a solution to achieve both objectives and to have higher economic impacts with complementary and synergy effects. The Comprehensive Asia Development Plan gives an example of the combination of the projects.

Third, there are some critical cluster-to-cluster links having large impacts on ASEAN as a whole. For example, the Dawei Deep Seaport project together with a SEZ and a link with Thailand will bring huge impacts on the Mekong region as a whole. Simulation results imply that regional funding initiatives should be pursued to those critical infrastructure projects, as surrounding countries may benefit from the Dawei project. At the same time, some key projects to connect between an ASEAN member states and a surrounding country should be regarded as prioritized projects as in a MPAC Plus concept and combined with current MPAC prioritized projects.

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